

General Mathematics

General Instructions

- Reading time – 5 minutes
- Working time – 2½ hours
- Write using black or blue pen
- Board approved calculators may be used
- A formulae sheet is provided at the back of this paper

Total Marks – 100

Section I

Pages 2 - 9

22 marks

- Attempt Questions 1-22
- Allow about 30 minutes for this section

Section II

Pages 10 - 24

78 marks

- Attempt Questions 23 - 28
- Allow about 2 hours for this section



Section I

22 marks

Attempt Questions 1 – 22

Allow about 30 minutes for this section

Use the multiple-choice answer sheet for Questions 1 – 22.

- 1 The value of $\frac{15.3 - 7.8}{\sqrt{1.9^2 + 3}}$ correct to three significant figures is:
- (A) 2.91
 - (B) 2.92
 - (C) 12.3
 - (D) 16.1
- 2 Jack wants to purchase a new set of golf clubs priced at \$2775. Which of the four payment options available would result in him paying the most?
- (A) Pay a deposit of \$800 and 12 monthly payments of \$190
 - (B) Purchase on finance at 9.25% p.a. over 2 years
 - (C) Pay \$240 per month for 12 months
 - (D) Pay cash and receive a discount of 10%
- 3 A coin is tossed three times. What is the probability that on the third toss it is a head?
- (A) $\frac{1}{8}$
 - (B) $\frac{1}{4}$
 - (C) $\frac{1}{3}$
 - (D) $\frac{1}{2}$

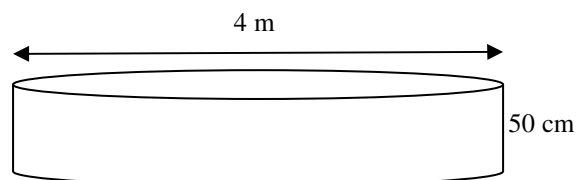
4 $m - n$ subtracted from $2m + n$ gives:

- (A) m
- (B) $-m$
- (C) $m + 2n$
- (D) $-m - 2n$

5 Craig covered the 400 metres of the drag racing strip in 10 seconds.
What was his average speed in km/h?

- (A) 90
- (B) 120
- (C) 144
- (D) 240

6 A cylindrical garden pool with diameter 4 metres and 50 centimetres deep needs to be sealed using waterproofing paint.



Which expression gives the surface area of the pool?

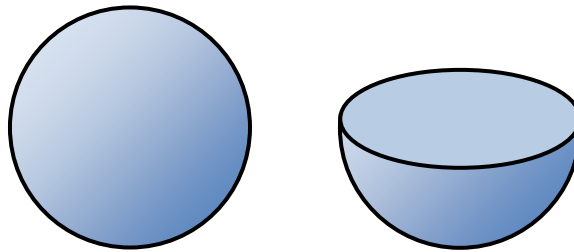
- (A) $2 \times \pi \times 2 \times 50 + 2 \times \pi \times 2^2$
- (B) $2 \times \pi \times 2 \times 0.50 + \pi \times 2^2$
- (C) $2 \times \pi \times 2 \times 0.50 + 2 \times \pi \times 2^2$
- (D) $2 \times \pi \times 4 \times 50 + \pi \times 4^2$

- 7 Over Easter, Dylan worked 16 hours at the normal hourly rate of pay and 16 hours at double time-and-a-half. He earned \$461.44 in total for this work.

What was the normal hourly rate of pay?

- (A) \$7.21
- (B) \$8.24
- (C) \$11.54
- (D) \$14.42

- 8 A sphere and a hemisphere have the same radius.



The ratio of the surface area of the sphere to the surface area of the hemisphere is:

- (A) 2 : 1
 - (B) 3 : 1
 - (C) 3 : 2
 - (D) 4 : 3
- 9 After nine games of netball the goal shooter has an average of 14 goals. In the next game she scores 24 goals. What is her new average?
- (A) 14
 - (B) 15
 - (C) 16
 - (D) 19

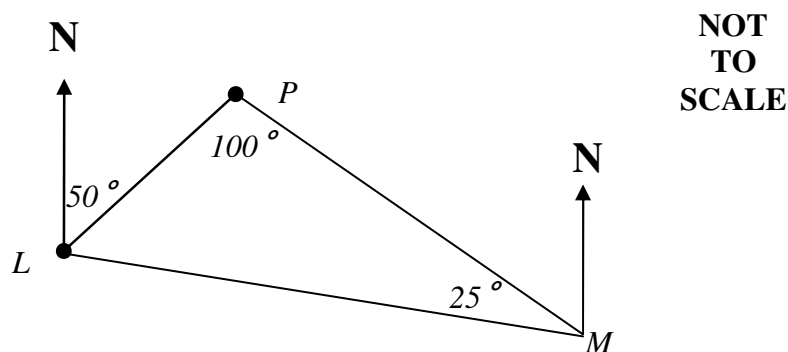
10 The radius of the Earth is approximately 6400 km. The circumference of the Earth at the Equator is closest to:

- (A) 1.28×10^8 km
- (B) 1.29×10^8 km
- (C) 20106 km
- (D) 40212 km

11 Which of the following statements is MOST correct?

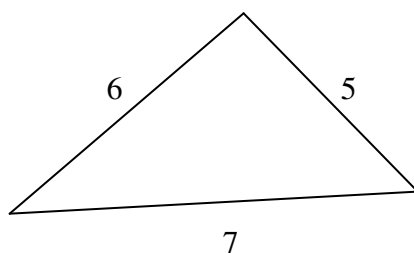
- (A) The median, mode and mean of a normal distribution are whole numbers.
- (B) The median, mode and mean of a symmetrical distribution are usually equal.
- (C) The median is the middle value in a list of data.
- (D) The mean of a distribution is the tallest rectangle on the histogram.

12 What is the bearing of L from M ?



- (A) 310°
- (B) 285°
- (C) 105°
- (D) 050°

- 13 What is the size of the largest angle in this triangle?



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- (A) 89°
(B) 78°
(C) 57°
(D) 46°
- 14 $\sqrt{2x+1} = 5$ then $x =$

- (A) 2
(B) 8
(C) 12
(D) 13

- 15 Karen's results in four different assessments are shown in the following table.

<i>Course</i>	<i>Class mean</i>	<i>Standard deviation</i>	<i>Karen's result</i>
English	66%	2	67%
Mathematics	58%	4	58%
History	72%	6	78%
Biology	81%	8	73%

In which course is Karen's z-score equal to 1.0?

- (A) English
(B) Mathematics
(C) History

(D) Biology

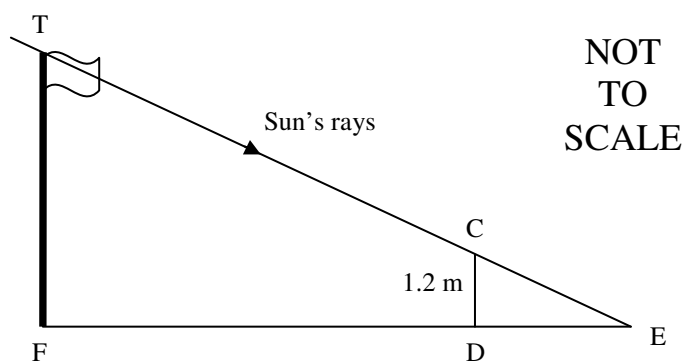
16 In how many ways can a team of 5 basketball players be selected from a squad of 8 players?

- (A) 13
- (B) 40
- (C) 56
- (D) 120

17 Which city is on the Equator?

- (A) $(35^{\circ}\text{S}, 0^{\circ})$
- (B) $(0^{\circ}, 35^{\circ}\text{S})$
- (C) $(35^{\circ}\text{W}, 0^{\circ})$
- (D) $(0^{\circ}, 35^{\circ}\text{E})$

18 A flagpole casts a shadow of 8 m. At the same time, a 1.2 m high vertical stick casts a shadow of 40 cm or 0.40 m. The height of the flagpole, to the nearest metre, is:



- (A) 20
- (B) 21
- (C) 24
- (D) 25

- 19 The careers adviser conducted a survey of last year's HSC students. The results are given in the following table:

	Further Study	Workforce
Boys	57	33
Girls	70	35

From the information in the table, what is the probability that a girl, selected at random from last year's HSC students, joined the workforce?

- (A) $\frac{35}{195}$
- (B) $\frac{35}{105}$
- (C) $\frac{35}{70}$
- (D) $\frac{35}{68}$

- 20 The table shows monthly repayments for loans over 30 years.

		<i>Loan amount</i>				
		\$200 000	\$250 000	\$300 000	\$350 000	\$400 000
<i>Interest rate per annum</i>	5.0%	\$1074	\$1343	\$1612	\$1881	\$2149
	5.5%	\$1136	\$1420	\$1704	\$1988	\$2272
	6.0%	\$1200	\$1500	\$1800	\$2100	\$2399
	6.5%	\$1266	\$1583	\$1899	\$2217	\$2532
	7.0%	\$1332	\$1665	\$1998	\$2331	\$2665
	7.5%	\$1399	\$1749	\$2099	\$2449	\$2798

Beth borrows \$350 000 over a period of 30 years at 6.5% per annum. Repayments are to be made monthly according to the table.

How much would Beth repay over 30 years if the interest rate were to remain the same?

- (A) \$2217
- (B) \$66 510
- (C) \$682 500
- (D) \$798 120

21 Which of the following would you expect to have a negative correlation?

- (A) Hours of weeding and weeds remaining in a garden
- (B) Weather and number of TV sets sold
- (C) Volume of loud party music and the number of noise complaints
- (D) Hand span and shoe size

22 Brian plays a game in which he has:

- $\frac{1}{20}$ chance of winning \$60
- $\frac{1}{2}$ chance of winning \$5
- $\frac{9}{20}$ chance of losing \$10

What is Brian's financial expectation when playing the game?

- (A) \$1.00
- (B) \$10.00
- (C) \$45.00
- (D) \$55.00

Section II

78 marks

Attempt Questions 23 – 28

Allow about 2 hours for this section

Begin each question on a new page.

All necessary working should be shown in every question.

Question 23 (13 marks) Start a new page for your answers.

- (a) Different vegetables are to be served for dinners at a school camp. A random sample of children was asked which vegetable they preferred. The results were as follows:

Vegetable	frequency
Peas	4
Beans	3
Carrot	6
Cauliflower	2
Zucchini	5
	20

- | | | |
|-------|---|---|
| (i) | What is the relative frequency of the most popular vegetable? | 1 |
| (ii) | What percentage of children surveyed preferred peas? | 1 |
| (iii) | On a sector graph what angle would be used to represent beans? | 1 |
| (iv) | Based on these results, how many of the 200 children attending camp could be expected to prefer zucchini? | 1 |

Question 23 continues on page 11

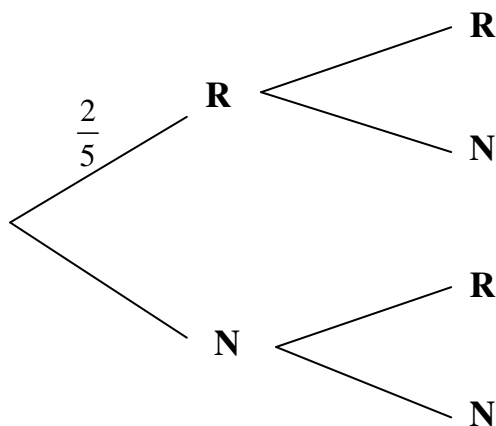
Question 23 (continued)

- (b) At the location for the school camp, the probability of rain on any day is $\frac{2}{5}$.

The camp is to be held over two days. In the following diagram **R** indicates “rain” and **N** indicates “no rain”.

- (i) Copy and complete the probability tree diagram.

1



- (ii) What is the chance that there is no rain on a particular day? 1
- (iii) What is the probability that it rains on both days? 1
- (iv) Calculate the probability that it rains on at least 1 day. 2
- (v) What are the most likely weather conditions they will encounter? Explain your answer. 1
- (c) Kevin wants to invest \$5 000 for 3 years and has the following choices:

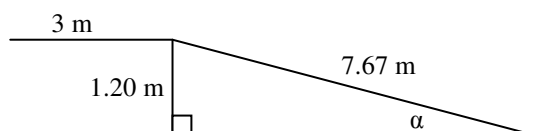
	<i>Investment for 3 years</i>
<i>Save With Us</i>	6.5% p.a. with interest paid each year.
<i>Savings Bank</i>	6% p.a. compounded monthly. <i>Interest paid at the end of the investment period.</i>

- (i) Calculate the total interest paid by *Save With Us*. 1
- (ii) Use the compound interest formula to calculate the total amount returned to the investor under the *Savings Bank* option. 2

End of Question 23

Question 24 (13 marks) Start a new page for your answers.

- (a) A wheelchair access ramp is to be built at the local shopping centre. The proposed design has a 7.67 m ramp rising 1.20 m to a 3 metre landing as shown.

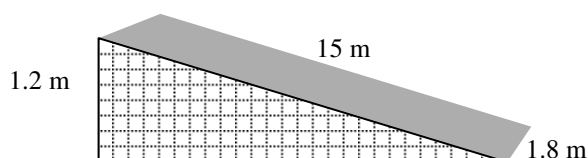


- (i) What is the angle of elevation, α , correct to the nearest degree. **2**
- (ii) Government regulations state that the angle of elevation of a wheelchair ramp should be no more than 5° .



What is the minimum horizontal distance required to make the ramp so that the angle of elevation is 5° . Answer to the nearest centimetre. **2**

- (iii) The builder decides to construct a ramp that is 15 metres long and 1.8 metres wide as shown in the diagram.



The top surface of the ramp is to be covered in outdoor carpet to improve surface traction. The carpet comes in rolls 0.9 metres wide and costs \$16 per linear metre. Calculate the cost of the carpet required to cover the top surface. **1**

- (b) Rome is located at $42^\circ\text{N } 12^\circ\text{E}$ and Sydney is located at $34^\circ\text{S } 151^\circ\text{E}$

- (i) What is the difference in longitude between Rome and Sydney? **1**
- (ii) When it is 12 noon Greenwich Mean Time, what time (ignoring time zones) should it be in Rome? **1**
- (iii) Anthony is on holidays in Rome and phones his friend in Sydney. If he calls at 9 p.m. on Friday, what is the day and time in Sydney? **1**

Question 24 continues on page 13

Question 24 (continued)

- (c) Dashan is paid a salary of \$77 948 and earns \$354 in bank interest. His allowable deductions amount to \$862.

- (i) Calculate Dashan's taxable income. **1**
- (ii) Use this tax table to calculate Dashan's tax payable. **2**

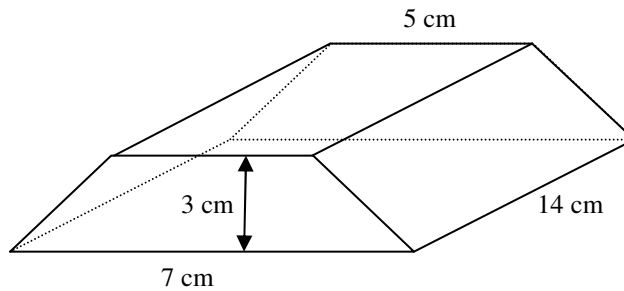
<i>Taxable income (\$)</i>	<i>Tax payable</i>
\$0 – \$13 000	Nil
\$13 001 – \$32 000	Nil plus 25 cents for each \$1 over \$13 000
\$32 001 – \$55 000	\$4750 plus 35 cents for each \$1 over \$32 000
\$55 001 – \$100 000	\$12 800 plus 45 cents for each \$1 over \$55 000
Over \$100 000	\$33 050 plus 55 cents for each \$1 over \$100 000

- (iii) As part of his taxation obligation, Dashan must also pay a Medicare levy of 1.5% of his taxable income. Calculate the amount of Dashan's Medicare levy using your answer from part (i) above. **1**
- (iv) If Dashan receives a \$6000 bonus, what percentage of the bonus will Dashan pay in additional tax? **1**

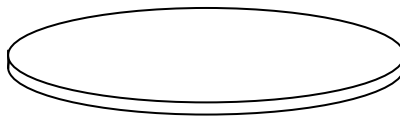
End of Question 24

Question 25 (13 marks) Start a new page for your answers.

- (a) To make the gold medals for the next International Games a goldsmith is given 10 gold ingots, each in the shape of a trapezoidal prism, with dimensions as shown.



- (i) What is the total volume of the 10 gold ingots in cubic centimetres (cm^3)? **2**
- (ii) The goldsmith melts the ingots and uses all the gold to make 210 gold medals. What is the volume of each medal? **1**
- (iii) Each gold medal is cylindrical and 0.4 cm thick. **2**

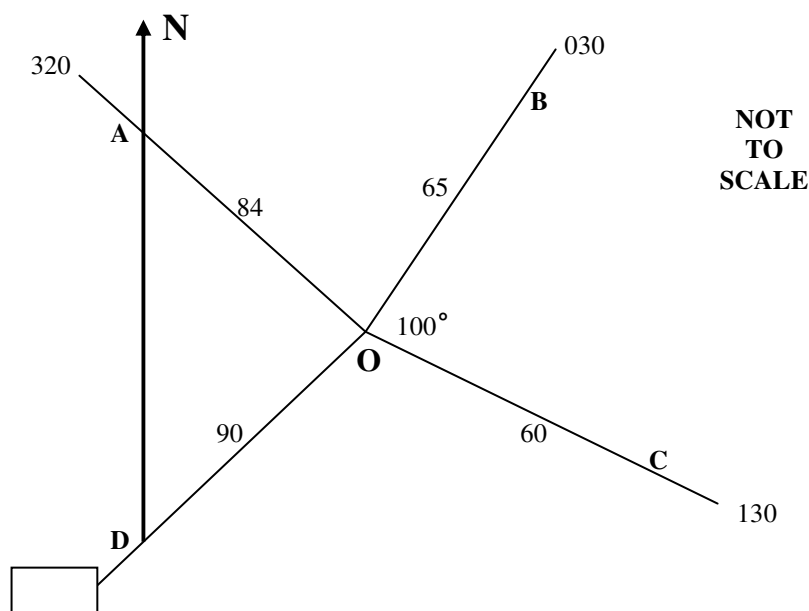


Find the radius of each medal to the nearest mm.

Question 25 continues on page 15

Question 25 (continued)

- (b) A trainee surveyor did a radial survey on a block of land and recorded the following in his note book.



- | | | |
|-------|---|----------|
| (i) | The trainee noted that $\angle BOC = 100^\circ$.
Calculate the area of triangle BOC to the nearest metre. | 2 |
| (ii) | Find the size of $\angle AOB$. | 1 |
| (iii) | Find the distance from A to B , to the nearest metre. | 2 |
| (iv) | The trainee realised he had omitted the bearing from O to D . Luckily he knew that A was due north of D . | 3 |

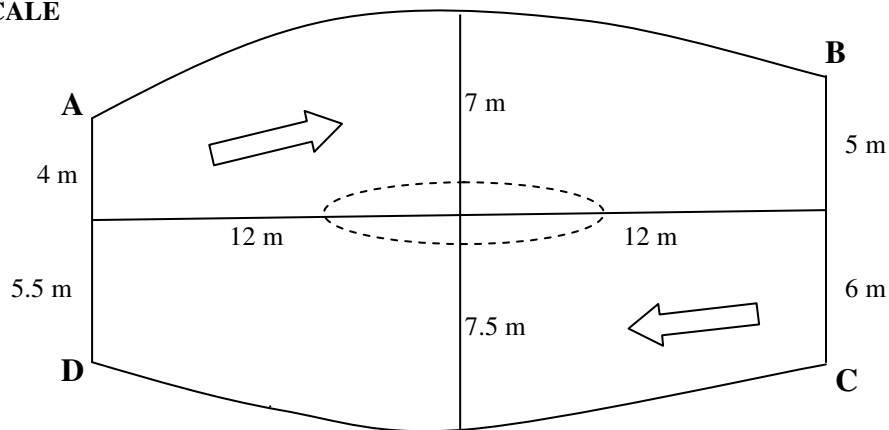
Calculate the size of $\angle ADO$, to the nearest degree, and hence find the bearing of **D** from **O** which is missing from his diagram.

End of Question 25

Question 26 (13 marks) Start a new page for your answers.

(a) The diagram below shows the new section of the school drop-off zone.

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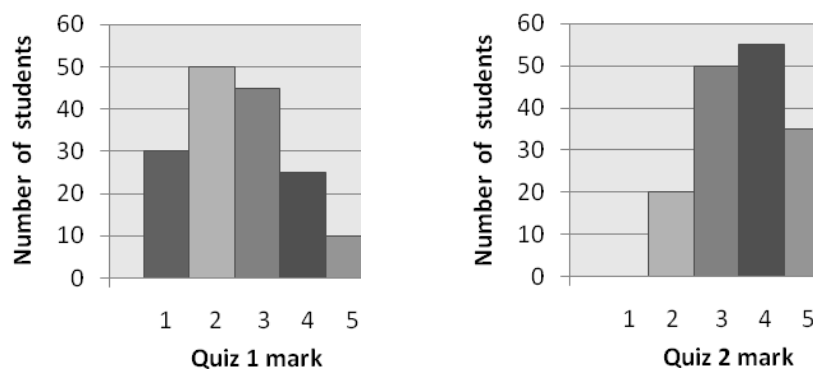
- | | | |
|-------|---|----------|
| (i) | Use Simpson's Rule with 2 applications to approximate the area ABCD. | 3 |
| (ii) | The elliptical garden bed at the centre of the drop-off zone is 10 metres long and 2.5 metres wide. Calculate the area of the garden bed to the nearest square metre. | 1 |
| (iii) | The concrete is 150 mm thick. The garden bed at the centre is not concreted. | 2 |

Calculate the volume of concrete poured for the drop-off zone.

Question 26 continues on page 17

Question 26 (continued)

(b) The following graphs show the quiz results for 160 students.



- (i) Calculate the mean and standard deviation, correct to 2 decimal places, for each of the quizzes. **2**
- (ii) Construct a double box-and-whisker plot for the quiz results. **4**
- (iii) Quiz 1 was taken before the topic was revised and Quiz 2 was given after the revision lesson. **1**

With reference to skewness, write a brief statement that compares the distribution of the marks from the first quiz with those from the second quiz.

End of Question 26

Question 27 (13 marks) Start a new page for your answers.

- (a) David wants to buy a work vehicle at the end of his TAFE course. He plans to deposit \$250 into an account at the end of each month for the 2 years of his studies. The account earns 4.8% p.a. interest, compounding monthly.

David's father agreed to match David's savings dollar-for-dollar. He used the present value of an annuity formula to calculate the single amount he needed to invest so he could achieve the same financial result as David's savings plan.

- (i) Explain why 0.004 is used to calculate the monthly interest. 1
- (ii) Write down the formula with the correct substitutions for David's father's investment. 1
- (iii) Find the amount David's father invested. 1
- (iv) Calculate the final value of David's investment. 2
- (b) At the conclusion of his studies, David decided to purchase a more expensive vehicle and borrowed \$16 000 to cover the additional costs. The interest rate of 7.8% per annum compounded fortnightly, and the repayments were set at \$265.

The loan balance sheet shows the interest charged and the balance owing after the first fortnight.

<i>Period</i>	<i>Principal at the start of the period</i>	<i>Period interest</i>	<i>Fortnightly repayment</i>	<i>Balance at end of period</i>
1	\$16 000	$16\,000 \times 0.003$ = \$48	\$265	\$15 783
2	\$15 783	I	\$265	II

Find the missing amounts I and II.

2

Question 27 continues on page 19

Question 27 (continued)

- (c) David wanted to calculate the number of fortnightly repayments, n , it would take to repay the loan fully. He used the ‘guess-and-check’ method to estimate n in the following equation.

$$\$265 \times \left\{ \frac{(1.003)^n - 1}{0.003 \times (1.003)^n} \right\} = \$16\,000$$

Here is his working.

Try $n = 50$:

$$\$265 \times \left\{ \frac{(1.003)^{50} - 1}{0.003 \times (1.003)^{50}} \right\} \approx \$12\,287$$

Hence $n = 50$ is too small.

- (i) David’s next guess is $n = 70$. Show David’s working for this guess, including the calculation and conclusion. 2
- (ii) State a reasonable value of n for the next guess. 1
- (d) David can claim the depreciation on his work vehicle as a taxation deduction. The vehicle cost \$29 000 and depreciates in value by \$4 000 per year for the first three years.
After the end of the third year, David changes to the declining balance method of depreciation as the rate is 25% per annum.
- (i) Calculate the value of the vehicle at the end of the third year. 1
- (ii) Calculate the value of the vehicle six years after it was purchased. 2

End of Question 27

Question 28 (13 marks) Start a new page for your answers.

- (a) The number of 20 cent ice-blocks sold at the school canteen is proportional to the square of the daily temperature as shown in the following table.

Temperature (T)	18	20	22	24	26	B
Ice-blocks sold (n)	81	100	121	A	169	225

The relationship between temperature (T) and ice-blocks sold (n) can be represented by $n = 0.25T^2$

- (i) Determine the values of A and B in the table. **2**
 - (ii) On the graph paper supplied produce a neat sketch of the data. **2**

Use the horizontal axis to represent the temperature and the vertical axis to represent the number of ice-blocks sold.
 - (iii) Use your graph, or a calculation, to determine the number of ice-blocks sold when the temperature is 16°C . **1**
 - (iv) What type of graph does the data approximate? **1**
 - (v) What would be the expected number of ice-blocks sold if the temperature was 36°C ? **1**
 - (vi) Calculate to the nearest degree, the temperature if 336 ice-blocks were sold. **2**
- (b) Priority is given to those who have the correct money.
- (i) List the nine combinations of coins that are possible when buying 2 ice-blocks at 20 cents each. **2**
 - (ii) What is the probability that a student pays the 40 cents using more than four (4) coins? **1**
 - (iii) What is the probability that a student's 40 cents does **not** include a 5 cent piece? Answer as a simplified fraction. **1**

End of paper

GENERAL MATHEMATICS

FORMULAE SHEET

Area of an annulus

$$A = \pi(R^2 - r^2)$$

R = radius of outer circle

r = radius of inner circle

Area of an ellipse

$$A = \pi ab$$

a = length of semi-major axis

b = length of semi-minor axis

Area of a sector

$$A = \frac{\theta}{360} \pi r^2$$

θ = number of degrees in central angle

Arc length of a circle

$$l = \frac{\theta}{360} 2\pi r$$

θ = number of degrees in central angle

Simpson's rule for area approximation

$$A \approx \frac{h}{3} (d_f + 4d_m + d_l)$$

h = distance between successive measurements

d_f = first measurement

d_m = middle measurement

d_l = last measurement

Surface area

Sphere $A = 4\pi r^2$

Closed cylinder $A = 2\pi rh + 2\pi r^2$

r = radius

h = perpendicular height

Volume

Cone $V = \frac{1}{3} \pi r^2 h$

Cylinder $V = \pi r^2 h$

Pyramid $V = \frac{1}{3} Ah$

Sphere $V = \frac{4}{3} \pi r^3$

r = radius

h = perpendicular height

A = area of base

Sine rule

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Area of a triangle

$$A = \frac{1}{2} ab \sin C$$

Cosine rule

$$c^2 = a^2 + b^2 - 2ab \cos C$$

or

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

FORMULAE SHEET

Simple interest

$$I = Prn$$

P = initial quantity

r = percentage interest rate per period,
expressed as a decimal

n = number of periods

Compound interest

$$A = P(1 + r)^n$$

A = final balance

P = initial quantity

r = percentage interest rate per compounding
period, expressed as a decimal

Future value (A) of an annuity

$$A = M \left[\frac{(1 + r)^n - 1}{r} \right]$$

M = contribution per period,
paid at the end of the period

Present value (N) of an annuity

$$N = M \left[\frac{(1 + r)^n - 1}{r(1 + r)^n} \right]$$

or

$$N = \frac{A}{(1 + r)^n}$$

Straight-line formula for depreciation

$$S = V_0 - Dn$$

S = salvage value of asset after n periods

V_0 = purchase price of the asset

D = amount of depreciation apportioned
per period

n = number of periods

Declining balance formula for depreciation

$$S = V_0(1 - r)^n$$

S = salvage value of asset after n periods

r = percentage interest rate per period,
expressed as a decimal

Mean of a sample

$$\bar{x} = \frac{\sum x}{n}$$

$$\bar{x} = \frac{\sum fx}{\sum f}$$

\bar{x} = mean

x = individual score

n = number of scores

f = frequency

Formula for a z -score

$$z = \frac{x - \bar{x}}{s}$$

s = standard deviation

Gradient of a straight line

$$m = \frac{\text{vertical change in position}}{\text{horizontal change in position}}$$

Gradient-intercept form of a straight line

$$y = mx + b$$

m = gradient

b = y – intercept

Probability of an event

The probability of an event where outcomes are equally likely is given by:

$$P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

Student Number

Class

HSC TRIAL GENERAL MATHEMATICS EXAMINATION 2010 MULTIPLE CHOICE ANSWER SHEET

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: $2+4 =$ (A) 2 (B) 6 (C) 8 (D) 9
A ☐ B ☒ C ☐ D ☐

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ☒ B ☒ C ☐ D ☐

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word *correct* and drawing an arrow as follows.

A ☒ B ☒ C ☐ D ☐
correct

ATTEMPT ALL QUESTIONS

- | | | | | | | | | | |
|----|-------------------------|-------------------------|-------------------------|-------------------------|----|-------------------------|-------------------------|-------------------------|-------------------------|
| 1 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 12 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 2 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 13 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 3 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 14 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 4 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 15 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 5 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 16 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 6 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 17 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 7 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 18 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 8 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 19 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 9 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 20 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 10 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 21 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 11 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 22 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |

Student Number

Class

Grid Sheet for Question 28a (ii)

